Journal of Population Therapeutics & Clinical Pharmacology

RESEARCH ARTICLE
DOI: 10.53555/jptcp.v31i6.6871

IDENTIFYING BARRIERS TO EFFECTIVE IMMUNIZATION AND MISSED OPPORTUNITIES IN RURAL AREAS OF PAKISTAN.

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ABSTRACT

Introduction: The vaccination process is necessary for the public health system to prevent the development of infectious diseases. Rural populations are more likely to face various difficulties than urban populations, such as accessing centers to receive life-saving vaccines. Due to this neglect, the vaccination rate is lower. This article will examine the challenges of vaccination in rural areas of District Poonch Pakistan and distill the obstacles and missed opportunities.

Objectives: The goal of the study is to get a better understanding of barriers to effective immunization to enhance immunization rates and achieve improved public health in the area from an emic perspective. To document the obstacles and opportunities lost related to immunization in remote areas of District Poonch, AJK.

Methods: The article conducted a study among parents and healthcare providers living in rural areas through in-depth interviews. The qualitative research method and a grounded theoretical approach were used. The interview results were analyzed using thematic analysis techniques to identify common themes and patterns present in the data.

Results: The study reported five meta themes and several sub-themes on important issues related to vaccine uptake. Several important issues were revealed by the data, which were related to access and transportation issues, lack of knowledge and awareness gap, socioeconomic barriers, health infrastructure issues, and most importantly, community support for the vaccination program shows room for improvement.

Conclusion: This study focuses on the challenges of vaccinating people living in remote areas. Policymakers and healthcare professionals can use information from this study to improve vaccination rates in underserved communities. Additional research and initiatives are needed to address the challenges and ensure equal access to vaccines for everyone.

Keywords: Immunization, Rural Health, Barriers, Vaccination, Qualitative

In the traditional sense, a biological product that produces protective immunity against infection is referred to as a vaccine. Every year, vaccinations save about 2.5 million lives. There are currently 26 infectious disease vaccines available worldwide. There are still more vaccines being developed or that have already received approval. There is no denying that vaccinations have a positive influence on contemporary society. Only by stopping the spread of infectious diseases which is also accomplished through vaccination can maintain the health of individuals living in densely populated urban areas (Piot et al., 2019).

Immunization safeguards the community in addition to the immunized person. Mass vaccination creates "herd immunity," a condition in which a large number of people are resistant to a specific pathogen, thereby reducing the exposure of unvaccinated individuals to pathogens and preventing disease, interrupting or shortening the gearbox chain for immune compromised individuals who are not candidates for vaccinations are also protected by this tactic. The best vaccinations are those that are simple to administer to the general public, safe, and have long-term efficacy. If a vaccine is put through extensive safety testing before being made available to the general public, then it is safe (Orenstein & Ahmed, 2017; Orenstein, Seib, GrahamRowe, & Berkley, 2014; Piot et al., 2019).

In developing nations, vaccine preventable diseases (VPDs) remain a serious public health concern, (Wolfson et al., 2008) because of this, immunizations save the lives of over 2.5 million children annually and are a reliable survival strategy for kids (Maurice & Davey, 2009). In low-income nations, about 10 million children under five pass away annually (Rutherford et al., 2009). Vaccination is a crucial tool to meet Sustainable Development Goal (SDG) 3, which is to lower the under-five mortality rate to less than 25 per 1,000 live births by 2030 (Organization, 2010).

Immunization is essential for protecting the public's health since it stops the spread of infectious illnesses. However, the reason for incomplete immunization and missed opportunities continue to be major problems in many regions with limited resources like in rural areas of the world, including the Poonch district in Azad Jammu and Kashmir (AJK). There are currently several vaccines available against infectious infections, many of which are intended for routine pediatric immunizations. Since its inception in 1994, Pakistan's Expanded Program on Immunization (EPI) has made significant contributions to lowering the incidence of diseases that can be prevented by vaccination. Pakistan launched the National Immunization Support Project (NISP) in 2016 to further amplify efforts to increase immunization rates and decrease vaccine-preventable diseases. The aim of the Expanded Program on immunization is at least 90% of the infants should receive the primary immunization series (Organization, 2006).

Twelve diseases—tuberculosis, poliomyelitis, pneumonia, meningitis, Hemophilus influenza, diphtheria, pertussis, tetanus, diarrhea, typhoid, hepatitis B, measles, and rubella—are the focus of the EPI in AJK (**Table 1**). In Poonch AJK, 80%– 95% of the core EPI vaccines have reportedly been administered, but this number includes inaccurate and partial immunizations. Furthermore, it has been demonstrated that immunization coverage is not consistent across the nation, with rural areas showing noticeably lower coverage and contributing to the spread of measles. Several variables that relate to the vaccines being used, to health services, or communities can affect the effectiveness of immunization programs in resource-limited settings, including the extent of the health network coverage, the availability and quality of outreach services, the quality of the cold chain, the coordination of communities with health services, the existence of population movements, and many others. Depending on the location, each of the aforementioned components' relative impact may change dramatically (Abdulraheem, Onajole, Jimoh, & Oladipo, 2011). In this situation, it is essential

to identify and implement suitable solutions by having a thorough awareness of the regional obstacles to successful immunization programs.

When	Age	Vaccines
At birth	At birth	BCG, OPV0, Hep B
2nd Visit	6 weeks	OPV1, Rotavirus, PCV1, Pentavalent1
3rd Visit	10 weeks	OPV2, Rotavirus2, PCV2, Pentavalent2
4th Visit	14 weeks	OPV3, IPV1, PCV3, Pentavalent3
5th Visit	9 months	Measles1, IPV2, Typhoid
6th Visit	15 months	Measles2

Expanded Program on Immunization Schedule 1

1.1.1 Background:

Vaccination is an effective and cost efficient healthcare strategy. It has been successfully implemented to prevent, treat, and eliminate potentially deadly infectious diseases. In 1974, the World Health Organization (WHO) established the Expanded Programme of Immunization (EPI) to ensure vaccinations reach all children. By 1990, EPI aimed to immunize every child against measles, tetanus, polio, whooping cough, and tuberculosis. Over time, advancements in vaccines and an increase in available vaccines have led to higher vaccination coverage targets (Lindstrand, Cherian, Chang-Blanc, Feikin, & O'Brien, 2021).

The Expanded Program on Immunization (EPI) makes vaccines available in over 100 countries, protecting children from over 20 diseases. This saves 2.5 million young lives annually. Vaccinations could prevent a staggering three million deaths each year, with 2.5 million being children under five who receive regular vaccinations. Despite these benefits, less developed countries still face challenges with diseases like measles, polio, diphtheria, and tuberculosis. The severity of these diseases is often unrecognized by healthcare professionals and parents in Western countries, where such diseases are uncommon (Carter et al., 2023).

Measles remains a significant threat in developing countries. Even developed nations are not immune, as seen in recent outbreaks in Europe and the US, facilitated by easy global travel. Despite the existence of a highly effective vaccine, measles is still a leading cause of death in young children around the world. While there has been progress in reducing measles-related deaths (from 540,000 estimated in 2000 to 77% fewer in 2005), in 2008, measles still caused an estimated 164,000 deaths, primarily among children under the age of five. The number of measles cases has increased recently because fewer people are getting vaccinated, which is a setback for measles prevention efforts. This has made health officials worry that the disease could come back in countries that have gotten rid of it or made a lot of progress in stopping it (Li et al., 2021).

OBJECTIVE:

The goal of the study is to get a better understanding of these obstacles to enhance immunization rates and achieve improved public health in the area.

Specific objective:

To document the obstacles and opportunities lost related to immunization in remote areas of District Poonch, AJK.

LITERATURE REVIEW:

Immunization is a cornerstone of public health; it protects various populations from many diseases that can be easily avoided. Thus, immunization is one of the most effective measures that may help protect populations from infection (Stein, 2011). Immunization has significantly reduced the spread of infectious illnesses on a global scale and is still a very cost-effective public health intervention (Pickering, 2009). Notwithstanding its advantages, there are still difficulties, particularly in rural

areas where access to healthcare is frequently restricted. It is essential to identify the obstacles and missed chances for vaccination to enhance immunization rates and prevent the reappearance of avoidable illnesses. To measure the effectiveness of immunization services locally, nationally, and worldwide and to inform policies for the eradication, elimination, and control of vaccine preventable illnesses, vaccination coverage levels and trends are utilized (Organization, 2013) (Organization, 2001) (Organization, 2000).

Vaccines are extremely important for protecting the community, but areas outside of cities face special problems when it comes to giving everyone the shots they need (Saman, 2023). Studies from different places in Africa, such as Uganda, Nigeria, and Togo, have shown why immunization programs are having trouble and what could be done to make them better. In Uganda, research has revealed several obstacles limiting the effectiveness of immunization. One key issue is the adverse impact of health worker attitudes on parents and guardians seeking immunization services. Rudeness, tardiness, and poor communication among healthcare providers have been major concerns
(Jammeh, 2023). Furthermore, transportation issues hinder the timely delivery of immunization supplies, affecting the cold chain team's ability to adequately support these programs. Vaccine stockouts further worsen the situation, underscoring the need for a reliable vaccine supply chain (Najda Janoszka & Kopera, 2014).

In rural Nigeria, research showed that missed vaccinations were caused by certain obstacles, including a lack of information about vaccines. Mothers' knowledge had a major impact on vaccination rates, indicating that many mothers were not well-informed or educated about vaccines. It was also difficult to reach and teach at-risk groups, such as those with low income and education levels. It is important to address parents' worries and objections about vaccine safety through targeted outreach and education campaigns (Abdulraheem et al., 2011). Research in Togo has identified obstacles to reaching full immunization coverage. The causes of low immunization on the issue are ambiguous and unclear. In addition to this, regional differences can be noted. Additionally, social and cultural considerations can have an impact on immunization. Moreover, the ability to target such problems appropriately is greatly limited as a result of the research methodology (Landoh et al., 2016).

As per the results of the study, various aspects hindered the adoption of vaccines in
Mexico Latin America, and the Caribbean (LAC). The affected aspects included social status, level of education, outlook on life, ignorance, aging, misconceptions of the vaccine’s poisonous nature, and knowledge of the commonness of the illnesses (Holon, 2024). Such situations led to the development of skepticism or outright unwillingness to receive the user vaccines, especially in the localities. Nonetheless, it was also revealed that shortcomings in receiving the vaccine and the insufficient healthcare service and training of the doctors. (Rutten, 2023). To address this shortcoming, the study recommended the development of mechanisms that should be adopted in increasing vaccine uptake across the different demographic groups of society; a call that needs to be complemented by integrated, on the-ground, and context-based research that is needed to systematically and comprehensively fill the knowledge gap.

Based on the outcomes of the present investigation, it is possible to suggest stating more focus on eradicating barriers to vaccination based on the outcomes in the LAC area. That is why it can be stated that measures for developing recommendations for vaccination should address not only the barriers for each of the defined groups aimed but should also consider the social and cultural factors influencing their decision. (Van Pelt, 2023). Based on such practice, it is advisable to incorporate such approaches in the formulation of vaccine acceptance for the public health surveys. Also, in terms of potential enhancements, extra research could be provided contributing to the populations’ and the healthcare workers’ preparedness for the vaccines, including with the help of the communities and from other sources. Evidence-based strategies and targeted research were recommended as viable ways to overcome vaccine reluctance and increase immunization rates in the Latin American and Caribbean regions (Guzman-Holst, DeAntonio, Prado-Cohrs, & Juliao, 2020).

Notwithstanding the notable decline in measles mortality, challenges remain in achieving global vaccination targets. Even if routine vaccination rates have gone up, particularly in low-income

countries in sub Saharan Africa, outbreaks in regions with poor coverage, such as the Congo, Nigeria, Tanzania, and Uganda, show how fragile these gains are (Fadl, 2024). The absence of a measles mortality reduction strategy in India jeopardizes regional and international goals (Minta, 2023). Despite the World Health Assembly's goal of a 90% decrease by 2010, vaccine-preventable diseases continue to account for 25% of fatalities among children under five, underscoring the continued need for intensive immunization programs and ongoing funding (Levin,
2023). The recurrence of outbreaks in regions with insufficient coverage emphasizes the necessity of ongoing watchfulness and funding for immunization programs to avoid regressions in the gains achieved.

The need to address missed opportunities in immunization efforts is another factor contributing to the difficulties in reducing measles mortality (Tampi, 2023). Regularly occurring gaps in immunization coverage increase community susceptibility to epidemics, especially in populations that are already at risk (Deal, 2023). To overcome these challenges, strategies for addressing hard-to-reach populations must be developed, and vaccination programs must be ensured to be long-lasting. Additionally, the introduction of innovative vaccinations to enhance immunization programs and reduce access gaps both opportunities and difficulties necessitates careful planning and resource allocation. Immunization obstacles need mitigation, while missed opportunity challenges need, to be rectified if the global health targets are to be met and there is to be continued success of measles mortality reduction through vaccinations (Duclos, Okwo-Bele, Gacic-Dobo, & Cherian, 2009).

A rural Guangxi, China, study illuminates the barriers to timely measles vaccine alleviation, concentrating on vaccine supply-side attributes. The inquiry identified various issues including insufficient healthcare funding, inflexible vaccination timetables, governance and leadership, poor provider involvement, and reduced routine vaccination coverage (Tang, 2021). Scientists suggest that all of them are contributing to the general deterioration in this indicator and align with the tendency reported in various European states. Additionally, attitudes toward vaccine intake and the massive role played by guardians' practical expression in metropolises intensify the problem, highlighting the necessity for a targeted effort to address them successfully (Wagner, 2014).

Another obvious discrepancy among children's access concerns the place of their residence. The centralized programs for immunization and insufficient professional involvement could be relevant to the urban territories (Hu, 2018). At the same time, rural communities benefited from the adoption of decentralized and mobile vaccination plans. The use of particular mobile teams has boosted the rate of childhood immunization inclined to better accessibility for those living in rural areas. Overall, the results suggested the policy actions aimed at the demand for timely and full immunization to maintain the level of herd immunity and respond to the urgent issue of measles elimination in low- and middle-income countries (Cheng et al., 2023).

Nationally, research conducted in the peri-urban slums of Karachi, the study found missed opportunities and obstacles to immunization. Household barriers, where decision-makers regularly refused consent for immunization, respondents' lack of retention of the EPI card, and the restricted use of outreach services for later doses in the vaccine schedule were some of the reasons for missed opportunities (Muhammad, 2023). Furthermore, it has been discovered that social and religious barriers—such as discrimination, beliefs regarding religion, and misinformation—prevent caregivers from accepting immunization, which results in missed vaccination opportunities (Habib, 2024). In addition, supply-side implementation obstacles were noted, such as staff members at immunization centers performing poorly or being careless, inadequate community mobilization training, and ineffectively allocating and using funding for outreach initiatives. Under these circumstances, probably, populations in the peri-urban slum areas had not been sufficiently vaccinated, and, thus, labor intensive and specific measures need to be designed and implemented to tackle the supply- and demand-side struggles and improve vaccination rates (Yazdani, Muhammad, Nisar, Khan, & Shafiq, 2021).

There was a report on a status analysis of impediments to the execution of EPI. Among concerns were financing the program inadequately, poor leadership and governance—government inabilities

following the 2011 devolution of health services, and insufficient funds available for transportation and cold chain maintenance (Ahmed V. &., 2014). Furthermore, fund distributions were significantly delayed. Together, all made the Expanded Program on Immunization in Pakistan less successful. A substantial part of the report was spent on a detailed and long list of barriers to immunizing children in Pakistan. Among the massive barriers was the country's inefficiency in investing the necessary resources to execute the Expanded Program on Immunization; hence, there was a lack of resources for transportation, cold chain maintenance, and general program running. Finally, other than inhibiting the daily running of the EPI, the current limitation to the budget also makes it harder to acquire vaccines and other appropriate supplies (Masud, 2012). This limitation automatically results in the country's low levels of immunization and level of effectiveness.

The devolution of health services to Pakistan in 2011 caused governance problems, and the present study places this as the primary issue. The health system, including the EPI, became fragmented and inefficient as a result of this decentralization. Weak stewardship at several levels of government has led to poor immunization program implementation, delays in decision making, and coordination problems (Shaikh, 2012). The obstacles to effective immunization that already existed have been made worse by these governance issues, producing a complex environment that makes it more difficult for Pakistan to reach the ideal rates of vaccination coverage (Shaikh, Haq, Tran, & Hafeez, 2018).

Several significant obstacles were identified as the main causes of the study on inadequate immunization and missed opportunities for vaccination among children under five in Karachi (Husain, 2016). A notable obstacle was the deficiency of information among parents concerning the vaccination schedule, as reported by 28.68% of parents. Missed doses resulted from their ignorance of the specific vaccinations and when their children needed them.

Furthermore, 21.31% of parents stated that they were reluctant to finish the immunization schedule due to concerns about the adverse effects of vaccines. Additionally, the deficit of vaccination coverage was facilitated by such problems as childhood illness at 17.21% and distrust of the government at 10.65% (Singh, 2019).

The survey conducted in Karachi identified the lack of funds at 2.45%, insufficient trust in medical workers, and the absence of vaccination in facilities:

"Facilities lost 4.09% of vaccination opportunities from unvaccinated children" within the period 2015-2020. Upon aggregation, these factors depicted the intertwined nature of knowledge, practical concerns, and societal values that influence successful immunization coverage (Hossain, 2021). The immunization sector requires an adequate response via the improvement of facilities, explanation to parents, and strengthening communal trust to ensure every child is fully vaccinated. Therefore, a series of factors are leading to under-vaccination and missed opportunities in Pakistan in general and in Karachi in particular (Qayyum, 2021).

In about 28.68% of parents, the doses were skipped because of not knowing the schedule of vaccines and poor vaccination coverage. This barrier was due to the misunderstandings of the parents about the vaccinations. To counter this issue, parental awareness through learning sessions, clinic appointments, group sensitization, and handouts should be availed. Concerns over side effects attributed to 21.31% of the parents who did not vaccinate their children. It might be said that a lack of knowledge, myths, and concerns about overreactions may make parents deprive their children of vaccinations (Khaliq, Sayed, Hussaini, Azam, & Qamar, 2017). In essence, the way to counter this issue is through counseling and spreading authentic information on vaccination. The high number of cases is thus cut down to safeguard infants by ensuring that they do not succumb to preventable diseases (Gul, 2016).

According to the study conducted in Muzaffarabad, only 74% of toddlers aged 1223 months had received all the recommended vaccines (Rehman et al., 2017). Factors that contributed to this low rate included living far away from clinical services, maternal illiteracy, poor socioeconomic status, family based obstacles in accessing vaccines, and being a female baby of a minority ethnicity. Those

results indicate the necessity of eliminating those barriers, increasing maternal and general education, expanding medical services access, and increasing awareness.

It is vital to solve the barriers to high immunization coverage in disaster-ridden areas. Poor maternal education, poor socioeconomic status, family constraints, and distance from health care appearance are the most recurring factors affecting it (Murtaza, 2016). In this case, to improve immunization coverage and protect the unprivileged population in highly disaster-prone areas like Muzaffarabad, Pakistan, one must provide unhindered access to immunization services, educate the people to emphasize the importance of immunization, and prioritize the female literacy rate.

In Shiekh Khalifa Bin Zayed AlNahayan Hospital Rawalakot, Pakistan, there are recognized barriers and missed opportunities while trying to make the vaccine more effective. The barriers identified were low maternal education level, mothers' unawareness about the value of immunization as a protective measure before the infection is caused, and socioeconomic background challenges. In practice, only 67.2% of mothers identified that they needed immunization to protect their children from infections suggesting a strong gap that could pose a threat to immunization attempts (Hussain et al., 2020). The other gaps that were noted in the study included gaps of mother's education concerning immunization as the rate of immunization was considerably higher among mothers with high levels of education. This, therefore, implies the need to bridge the existing gap among mothers, especially those from the less developed regions of the country in terms of education and awareness concerning available immunization to reduce the possession of low immunization coverage and the instances whereby children may be protected against diseases that could have been prevented through the immunization programs. (Ahmed S. J., 2023).

In conclusion, one would like to point out that the problem of low efficiency of vaccinations as one of the primary tools of public health in the world and a crucial global priority remains urgent, particularly in countries with limited-resource settings and rural communities. Knowledge gaps about vaccination barriers are raised in such areas as, medical staff conduct, mobility potential, vaccine shortage, myths, social interaction, bad governance, and inadequate funding. This increases the vulnerability of the clusters more prone to the diseases in the first place by affecting their chances of getting vaccinated or availing preventive measures.

METHODOLOGY:

Methods:

The ISSM Consolidated Criteria for Reporting Qualitative Research, or the COREQ, is used in considering material to include in the methodology section.

Study Design:

"To capture the complex web of events, feelings, and ideas that determine life, qualitative research is comparable to an evolution of the human narrative". Instead of simply quantifying demographics, this platform focuses on people's tales and tracks down the nuances as well as subtleties that differentiate from person to person. This technique shines very best when attempting to comprehend the most complicated aspects of our lives that can not be readily measured by feelings, motivations, and social concerns. Consequently, researchers frequently interview subjects one on one, in groups, and spend time with direct observational to obtain these critical perceptions.

Moreover, this flexibility is what makes qualitative research exciting. As researchers delve deeper into people's lives, they may stray from the original plan to allow unexpected revelations and twists to shed additional light on the topic at hand. After they collect these stories, the real detective work begins. Researchers examine the stories in pursuit of various recurring themes, patterns, and random connections. In other words, qualitative analysis is the process of sorting, organizing, and at times categorizing data to uncover its deeper meaning. Scientists utilize such methods as theme analysis or narrative analysis, among others, to better illustrate the big picture. Consequently, qualitative research gives us a view of what it means to be human and grants us valuable knowledge to impact policy, influence decision-making, and most importantly, to continue studying various fields of study.

This research used a qualitative study methodology and was exploratory. A constructive research methodology was used to gain an emic viewpoint on how the field operates. The Emic perspective is also known as the Insider's perspective.

Setting:

The major subject of the study was District Poonch's rural areas of Azad Jammu and Kashmir (AJK). Azad Jammu Kashmir is a hidden gem located amidst the beautiful Himalayan and Karakoram mountains. These mountains are not only beautiful; they are also an integral part of the culture and the environment. The people in this region have a close connection with the mountains, and they define the region's tradition and culture. This is a blend of nature's beauty and rich heritage.

AJK is located at the crossroads of cultures and history the region is surrounded by the provinces of Punjab in the south and Khyber Pakhtunkhwa in the west of Pakistan. Because of the previously described geographical location, the unique legacy and expressions of the region have become a mix of traditions, languages, and ways of life. Their boundaries with the Indian administered Jammu and Kashmir lie mainly to the east and northeast. Some notable issues have been its edge or line of division, which has raised questions and speculation about regional tension and dispute. Living close by has made this area of more than average importance in the geo-strategic sense. It is almost as if one is situated at a junction on South Asia's multi-woven political map, adding yet another dimension to an already fascinating story.

Despite its strategic significance, and a majestic background--lush valleys, dense woods, and sparkling rivers--AJK has remained a mystery to the outside world. Even though its geopolitical significance and tourist attractions are better known to the countries and districts touching on AJK than themselves, few people have heard of AJK, making it a comparatively unfamiliar place.

Data Collection:

The qualitative study "Barriers to Effective Immunization and Missed Opportunities in Rural Areas of District Poonch AJK" received ethical clearance from the Institutional Review Board (IRB) of the Health Services Academy in Islamabad on January 9, 2024, under protocol number **F.No. 000341/HSAMSPH-2022**.

In-depth interviews with parents and prominent healthcare professionals were conducted as part of the data collection process to examine effective immunization hurdles as well as opportunities lost in remote places. The reason for choosing a qualitative technique was the aim to understand the participants' viewpoints and experiences entirely. Out of the eighteen interviews completed, fifteen that were necessary were picked for the study because they were related to the research question and could give a detailed explanation of the challenges stressed.

Purposeful sample methods were used to make sure the interview respondents came from diverse backgrounds that encompass parents, caregivers, community leaders, and medical experts. Therefore, the participants were selected based on having first-hand knowledge of the immunization process and living in a rural context of the District Poonch AJK residents. In-person interviews with the participants were used to help create an environment of openness and trust. For instance, there was a semistructured interview guideline was used to have a standard set of questions but at the same time, the interview provided enough freedom to discuss any new issues.

The overall objective of the study was achieved through the major research questions formulated in the form of openended questions. The community perspective on vaccination, attitudes, perceived challenges in vaccination uptake, logistics issues, and medical facility accessibility were all discussed. Every participant agreed and was audiotaped before reading the interview. Their confidentiality was safeguarded from the time the data was being collected up to the moment the transcription was completed. The entire interview was audiotaped with the agreement of the participants, and field notes were taken to preserve any non-verbal and other valuable contextual data. After the entire interview was transcribed, a thematic text analysis was completed to identify common subjects and issues raised

in the participants' comments. This study's findings will help to clarify the existence of immunization suffering in remote areas and offer a guide to subsequent studies and interventions.

DATA ANALYSIS:

A grounded theory methodology was utilized in the collection and analysis of the data. This method enables the generation of themes and concepts as the data compilation progresses without any preconceived theoretical assumptions or bias. It also enabled us to identify when data satiety was reached, which meant that no more interviews were necessary. The recordings of the interviews were initially transcribed verbatim to ensure that the participants' perspectives were conveyed accurately. After typing the interviews, the audio-recorded interviews were transcribed verbatim one by one. Transcripts were coded and organized by a transcriber using MAXQDA and other qualitative data analysis programs. The process of closely examining a section of text and labeling each one with relevant concepts, ideas, or themes that contribute to the study was called coding. As a result, recurrent ideas and themes in the text's body become easier to recognize. Codes were further categorized and organized into broader groupings based on the common themes found within them. The repeated comparative processes were used in the investigation to regularly examine and compare the interview data within and between subjects. The comparative approach was to help highlight similarities and differences regarding the participant's experiences and views. This repeatable process allows us to develop a full understanding of the hindrances to vaccination achievement and the opportunities squandered in rural regions. The themes and subthemes were discovered during the thematic analysis done after sorting and coding the data. The themes offered the windows through which to view the complex process of vaccine acceptance and distribution in rural areas, applying clusters of meaning and importance that were evident across several individual interviews.

Several important issues were revealed by the data, which were related to accessibility and transportation, unawareness and insufficient knowledge, financial difficulties, healthcare system problems, and community-based support and involvement. As it is shown in **Figure 1**, the themes, subthemes, and meta-themes of the study were the following:

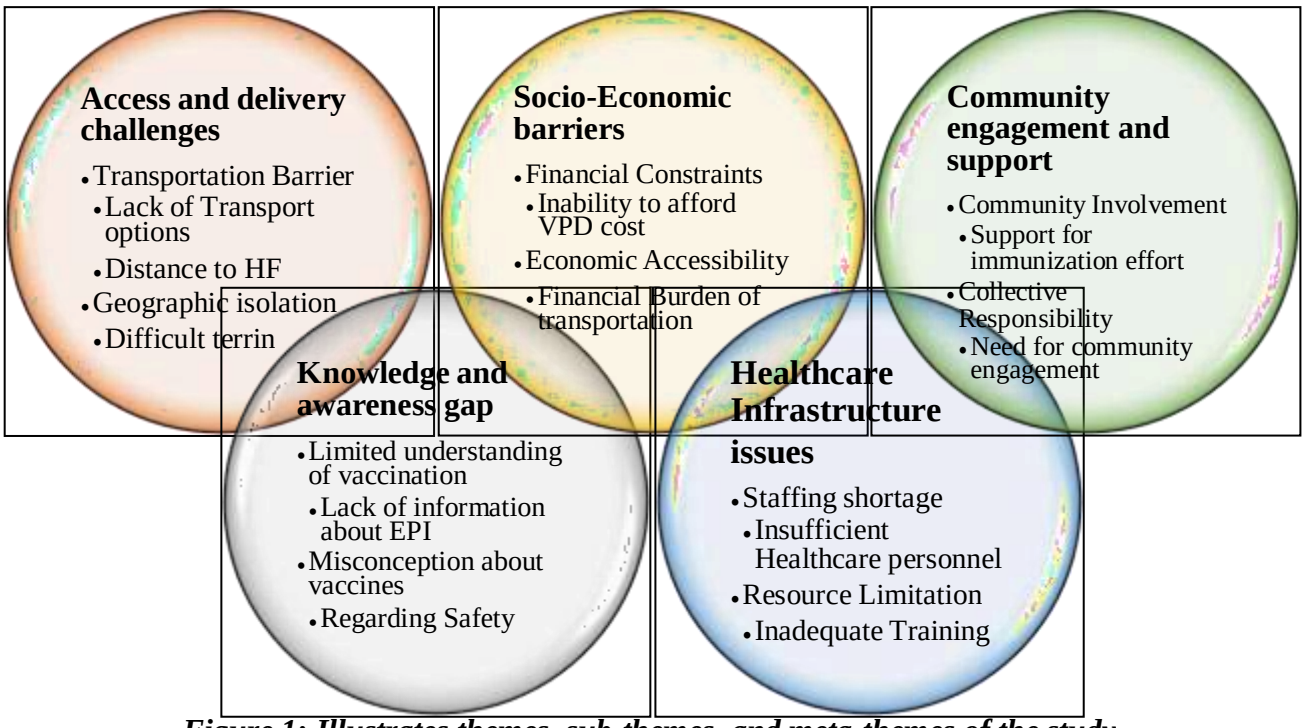

Figure 1: Illustrates themes, sub-themes, and meta-themes of the study

All the quotes and experiences from the interviews that supported each issue helped create a vast and comprehensive backdrop for the study. The data analysis allowed the identification of the specifics

of vaccination efficacy in the remote areas, which would have been lost as it was impossible to investigate those niches closely without obtaining such information directly from the participants. The present study, therefore, generated essential findings and information that could be used for particular actions, policy recommendations, and a comprehensive review of vaccination coverage and distribution in rural areas.

RESULTS

Sr. No.	Age	Gender	No. of Children	Education Level	Village	HH Size	Distance to HF	Mode of Transportation	Vaccination Awareness	Challenges	Community Involvement	Suggestions to Improve
1	26	Female	1	Second Year	Kaithan	8	40 mins-1 hr	On foot, Car	Limited	Dispensary far, Weather, Accessibility	Supportive	Establish vaccination camp locally during high demand
2	44	Female	4	MBA Student	Nakran	5	Not Specified	On foot, Car	Limited	Distance, Cost, Timebound services	Some Resistance	Increase awareness, Provide easier access
3	28	Female	2	Masters	Beikh	2	30 mins	On foot, Car	Limited	Distance, Accessibility, Awareness	Some Support	Establish a vaccination center locally
4	60	Male	2	Not Specified	Hajeera Desa	Not Specified	7-8 km	On foot, Car	Limited	Distance, Accessibility, Awareness	Some Support	Establish a vaccination center locally
5	30	Male	Not Specified	Not Specified	Phagwati	Not Specified	6-7 km	Car, Walk	Limited	Accessibility, Awareness, Weather	Supportive	Establish a vaccination center closer to communities
6	35	Female	3	Bachelors	Tain	6	1 hr	On foot, Car	Limited	Distance, Time, Cost	Supportive	Mobile vaccination units
7	50	Male	4	Primary	Rehara	7	45 mins	On foot, Car	Limited	Distance, Weather, Cost	Some Resistance	Increase awareness, Mobile units
8	38	Female	2	High School	Pakkhar	5	1 hr 15 mins	On foot, Car	Limited	Distance, Accessibility	Supportive	Establish a vaccination center locally
9	45	Male	3	Not Specified	Ali sojal	Not Specified	50 mins	Car, Walk	Limited	Distance, Cost, Weather	Some Support	Mobile vaccination units
10	29	Female	1	Bachelors	Khalidraman	3	1 hr	On foot, Car	Limited	Distance, Accessibility, Time	Supportive	Establish vaccination camps during specific times
11	55	Male	3	Secondary	Tatrinoot	4	35 mins	Car, Walk	Limited	Distance, Cost, Weather	Some Resistance	Increase awareness, Establish more centers
12	31	Female	2	Masters	Hajeera	6	1 hr	On foot, Car	Limited	Distance, Accessibility, Awareness	Supportive	Mobile vaccination units
13	22	Female	0	College Student	Ghamir	5	30 mins	On foot, Car	Limited	Distance, Weather, Time	Supportive	Establish vaccination camps locally
14	33	Male	1	High School	Tata Pani	Not Specified	40 mins	Car, Walk	Limited	Distance, Accessibility, Weather	Some Support	Mobile vaccination units
15	27	Female	2	Bachelors	Dara Shair Khan	4	1 hr	On foot, Car	Limited	Distance, Accessibility, Cost	Supportive	Increase awareness, Provide easier access

Interviews on lost opportunities and barriers to effective immunization conducted in AJK's rural districts have several significant themes in common. These topics reflect the community's challenges in obtaining immunization services and provide some thoughts for potential development projects in the future.

Accessibility/Transportation Challenges:

One of the most prominent difficulties was presented by the challenge to travel long distances and insufficient means of transportation to the medical facilities for vaccinations. Numerous interviewees have highlighted the miles they had to cover to get to the medical center, which was often made on foot or the necessity to rent an automobile.

"The health facilities are about 7-8 kilometers away from our house. If the weather is bad, then it is necessary to rent a car. But in normal days it is customary to walk on foot." This respondent's experience certainly shines a light on a serious issue many people face trying to get healthcare services, including, of course, getting vaccinated. Being consistently 7-8 kilometers away from a health facility – that's a long walk. And then, there are other issues, when the weather is bad, walking becomes even less of an option. When it's pouring rain or unbearable heat, walking to the health center might not just be tiresome but dangerous. In that respondent's words, from time to time they had to rent a car just to figure out how to get necessary care without any harm. At the same time, in all such marginalized locations, in this commenter's too, they still managed to figure out how to address these challenges, using, often, their own feet. That's quite a dedication, right? So, all in all, this story demonstrates that the faster we move towards making healthcare services [1] accessible and developing infrastructure in every corner of the country, the better. This step would fix a lot in terms of who gets to be vaccinated and who gets healthy.

By way of illustration, one respondent estimated that walking to the medical institution would take them between forty and sixty minutes, and another emphasized the significance of booking a car, especially during severe thunderstorms. ***"It takes about 40 minutes or an hour to reach the HF. I have to book a car If the weather is bad." "It's far away There is an issue with roads When there is no local convention, you have to book a special route and the cost is high so the local convention route is easier."***

The first respondent tells how much time and effort is spent just on walking to the healthcare facility. Could you believe that you have to walk 40 minutes to an hour, regardless of the weather, in the rain, in the sun, solely to get assistance? This is not only time-consuming but also tiring. Not everyone can effectively do so, especially an older person or with a malfunction. It is challenging to do such a thing if you do not feel well. The second respondent mentions the difficulties encountered as soon as the rain starts. A thunderstorm is not the best time to walk, as it is dangerous and impossible. It is, therefore, necessary to book a car. And here is not only comfort but primarily protection because it is possible to get to the doctor without exposing yourself to risk. Also, they talk about the challenges of the roads. If there are no local streets, you will have to pay extra for a specific street. However, such a free system is almost impossible because it is difficult for many families to book a car. Both tales have a common theme, getting to the healthcare facilities is challenging. Relying on the distance, climate, and paths, it is clear we need more convenient transportation modes and easily available medical facilities in rural areas. Every individual must have a comparable opportunity to receive attention, but safely and affordably.

Another interviewee raised the challenges of waiting for a lift and getting over them, emphasizing the barriers in place that keep individuals from getting immunizations.

"The health facility is 6-7 km from our BHU in Desa. It takes us more than half an hour to get there. In between, there is a drain and a lift. We have to cross the lift. Some people do not sit on the lift. Some women do not sit on the lift. Because of this, there are many problems in the distance."

The respondent has given a series of significant issues that people face as a result of some of the numerous laws before getting immunizations. Firstly, the distance between the health institution to Desa's Basic Health Unit is 6-7 kilometers it takes about more than 30 minutes. The distance between health institutions makes it challenging for people as many of them find it hard to access health services. Secondly, the use of the lift and a drain is also a challenge to some, especially those with physical challenges as the individual using a wheelchair may find it hard to access the sink to the lift. Even some women find it hard to use the lift due to their cultural or religious beliefs.

Lastly, the shortage of accessible and dependable transportation possibilities further complicates the situation. People are forced to find transportation to visit the factory when they are supposed to, which adds to the list of obstacles. Taken together, these examples illustrate just how tough it is for people to get vaccinated and receive other essential medical care, underscoring the need to come up with strategies to guarantee equitable access to treatment for everyone in the neighborhood.

Lack of Awareness and Information:

All the interviewees responded in the negative when asked if they were aware of any information concerning the Expanded Program on Immunization and the types of vaccines they were receiving. This layer of misinformation involved the misconceptions and doubts about the immunization process making it harder to address the reality.

"I don't know Maybe it is a type of disability If it is not done"

"We have been vaccinated from the beginning to protect our children from the disease. For example, it protects against diarrhea and polio."

"There are many people Despite being educated don't get vaccinated My motherin-law doesn't get vaccinated She fights with me every time Last time she was very sick Her daughter was also sick for a month She has 3 children She never got vaccinated We depend on Allah."

Most interviewees exposed a notable misunderstanding of the type of vaccines they received and the Expanded Expanded Program on Immunization, creating a lot of uninformed descriptions of the immunization process negatively and skepticism of Remedies and the EPI project, principally likely, also disinformation about it and poor perception of its work. Responses like "I don't know" signaled a lack of information about the immunization process. The last response,

"Maybe it is a form of disability if it is not done," implied an overall unfamiliarity with the importance and value associated with vaccination. Such knowledge gaps demonstrate why there is a need for further education and public programs aiming to help people know more and be informed about the vaccines they receive and the immunization program in general.

Furthermore, although all the respondents indicated some advantages of vaccination, such as protection from diarrhea and polio, they seemed to lack information on the issue. That is, their knowledge indicated to the respondent's need to know more about different vaccinations, their benefits, and the necessity to follow the schedule.

Moreover, attitudes towards vaccination were noted to be related to family and cultural factors as well. Some participants mentioned the difficulty of promoting diseases in their populations, partially because they are rejected based on their cultural and personal background. It allowed for clarification of the difficulties of dealing with vaccine hesitancy as well as the potential power of cultural-specific approaches when stimulating vaccination and weakening the impact of myths.

Several interviewees confessed that they were ignorant of EPI, but some emphasized the necessity of more discussion and education to enlighten the public on the importance of vaccination.

"I don't have any information about EPI.

But the EPI center keeps giving me a notebook copy. They do some studies on it.

In which they vaccinate against various diseases. That's all I know."

There is not enough public awareness around the Expanded Program on Immunization, as several interviewers admitted that they were not aware of EPI or familiar with the data. More specifically, one respondent mentioned that she was given a copy of the notebook at the EPI center, but "I don't know the benefits of EPI, the objectives of EPI." Nonetheless, the confidence that the authorities will ensure vaccination is encouraging. A strong agreement with the need for more talks and campaigns to help citizens learn about vaccines and respond better in terms of utilizing them added emphasis on the need for concentrated efforts aimed at narrowing the gap, debunking myths, and stirring up collective action among community members.

Financial Constraints and Health System Issues:

Another fact to be proven was the presence of a barrier to the opportunity to pay for immunization services. Several interviewees mentioned that they had no financial issues, while the other participants noted that some people living in their communities had problems related to the severe means.

"Secondly, they are poor. They are very poor people. Because of this, they have problems getting vaccinated. So, we are **thankful to God that nothing bad has happened.**"

Additionally, access to medical experts and immunization barriers was noted. A couple of interviewees mentioned cases where a lack of personnel or supplies prevented the provision of immunization services in medical facilities. Additionally, the same reasons were mentioned in the line.

"Earlier when we used to go to the dispensary, there was no one there If you are there, you have LHV and the doctor is not available."

Problems faced through the course of the study Many of the people who were interviewed made it clear that financial costs were the biggest sources of immunization services. While some claimed they did not struggle to pay for medical treatment, others noted the hardships their community members underwent due to limited financial resources. For example, one of the respondents stated, "Secondly, they're poor. They do not have anything. Because of that, they cannot acquire emergency vaccinations… So we thank God that it didn't go that way". This viewpoint highlights the need to immediately eliminate financial restraints that bar vulnerable groups from obtaining critical immunization remedies.

When it comes to vaccination programs, budgetary constraints were a distant second to logistical challenges about manpower and materials. Some interviewees shared their experiences about a time when people could not be immunized because health institutions had insufficient workers or resources to do so. One of the participants noted: One of the participants said: "When we used to go there, the dispensary used to be empty. If you are here, you have LHV and a doctor who is not approachable; this shows the importance of appropriate manpower, vaccine supply, and other resources for sustaining the provision of vaccination services. It is critical to address these logistics challenges to promote the provision of immunization services to all community members.

Community Engagement and Support:

Despite the challenges, there was a sense of community and cohesion in running the immunization. With more sept than others, many participants talked about the importance of the community in immunizing and the drive to make sure children get their shots at appropriate intervals.

"There should be awareness You should meet people Proper guidance should be given."

Another participant underscored the importance of keeping local communities involved in the immunization process to increase coverage.

"The local people have to share their responsibilities with the local people so that it can be easier and better."

Regardless of the challenges they faced in accessing immunization services, a majority of the respondents stated that the community supported the immunization program. More people pointed out the need for community support to ensure the success of immunization campaigns and ensure that the vaccines are administered to children promptly. According to one person's response: "Be aware, you must interact directly with the community." You must interact with others. Then offer a suggestion. The response underscores the need for extensive community mobilization and education to dispel myths, create awareness of the importance of immunization, and make vaccines accessible to children at the appropriate time.

A single respondent further agreed that shared responsibilities must be increased to make accessibility and coverage a reality, but noted the essential role of local communities in this respect. **"Make things easier and better, but locals must share with the locals".** From this perspective, local communities and local healthcare staff must collaborate to reduce access barriers and minimize vaccination to

identify and address existing gaps in immunization programs. When local communities own immunization, participants feel more responsible and the same is extended to the effectiveness and sustainability of vaccination campaigns.

Suggestions for Improvement:

The answers of the respondents present very useful recommendations for the improvement of immunization campaigns. The EPI clinics should be established in the areas, where they could be easier accessible; the family should have easier access to transportation and there were also interesting suggestions to raise awareness of the immunization campaigns.

"Sir, my suggestion is that the EPI centers should be the closest to the Dehi areas. It should be at a distance. So that women can easily get their children injected on foot or in the form of vehicles. There are a lot of problems with going to some remote areas. And women get sick due to some diseases. Therefore, it becomes a big problem to take the children on foot".

In addition, they suggested setting up immunization camps in remote areas to address the difficulty of traveling to medical institutions and backed the planning of transportation services for families during inclement weather.

"Sir, the wisdom of the practice is that the EPI centers should be as much as possible. And besides that, there should be awareness among the people. There should be health insurance. And people should be told about the EPI."

"I think it is better when more kids are there to arrange a camp and to go to the camp and to get vaccinated there. It is better to have a midpoint."

The participants offered valuable recommendations for enhancing immunization campaigns, stressing the significance of accessibility, cognizance, and community involvement. **"Sir, my suggestion is that the EPI centers should be the closest to the Dehi areas,"** said a respondent who advocated for the establishment of EPI centers closer to places with high population density. It ought to be separated so that mothers can conveniently inject their kids whether walking or riding in a car. Traveling to certain isolated places comes with a lot of challenges. And some diseases affect women more than others. As a result, walking the kids becomes very difficult. This recommendation emphasizes the necessity of placing EPI clinics in strategic locations to reduce travel times and improve accessibility to immunization services, particularly for women and children.

Respondents also suggested setting up vaccination camps in isolated areas as a workable way to deal with the difficulties associated with getting to medical facilities. **"I think it is better when more kids are there to arrange a camp, to go to the camp, and to get vaccinated there,"** said one reply. There should be a halfway point. This suggestion emphasizes the possible advantages of setting up mobile vaccination clinics to target underprivileged areas, offering a centralized site where families may more easily receive vaccination services.

Moreover, there was a recommendation for enhanced awareness regarding immunization and the utilization of health insurance to reach out to some families using healthcare facilities. In this perspective, a respondent stated: **"Sir, for more awareness, make sure to vaccinate and also let the people know, EPI centers should be as much as possible".** Again on the issue of awareness, the respondent adds the importance of the multi-value radiative position is to enhance initiative methods of awareness to ensure that all families understand the essence of immunization and the value of insurance to access healthcare facilities and widen their knowledge. Eventually, the answer supports the fact that action will lead to the improvement of the community's health and vaccination process.

To conclude, the thematic analysis of the interviews conducted in rural settings reveals that the community is confronted with multiple barriers to accessing and utilizing immunization programs. While it is possible to enhance immunization coverage and promote effective vaccine delivery to rural communities, it is through the use of targeted interventions addressing accessibility, awareness, financial barriers, and community engagement.

DISCUSSION:

Immunization is directly and indirectly affected by numerous social, cultural, political, and economic determinants (Shen, 2014). Individual immunization practices are impacted by multiple factors, including financial costs, geographical accessibility, awareness and knowledge, perceived risks and benefits, and health system and community norms, as well as the weather, confidence in immunization providers, previous encounters, and the availability of information (Sodha, 2015). The interactions among the constructs highlight the multilevel, multi-dimensional complexity of vaccination-making processes.

This study highlights several reasons for the lack of vaccinations in AJK and district Poonch in particular. Firstly, distance to health facilities has been identified as a potential barrier to increased vaccination rates. Several studies conducted previously on vaccination uptake have identified distance as a barrier to vaccination rates as well. Such as two studies conducted on COVID-19 vaccination uptake identified long distances to health facilities as a barrier and reducing distances as a facilitator to increased vaccination rates (A. Mazar et al., 2022, 2023). Lesser distances reduce the logistical requirements that are needed for travel such as cars or bikes. Locations that are easily reachable on foot tend to be more visited among the poorer communities thus making geographical accessibility one of the prime interventions that can be done to facilitate vaccine uptake. Of course, some studies provide a counter-argument to such interventions such as a study conducted in Africa on HPV vaccination found that geographical proximity to safety-net clinics is not significantly associated with HPV vaccine initiation among low-income, ethnic minority girls (Jennifer Tsui et al., 2013).

Another factor that serves as a major obstacle to vaccination uptake has been a lack of awareness about the immunization programs and ease of access to information for the general public. Our study showed that people with little insight into the importance of vaccines and their benefits have variable incentives to follow through with the campaigns as well. Numerous programs in the public health sphere have shown that simply providing services to the general masses does not necessarily translate to high usage of the commodity itself. Until and unless the layman is sensitized to the service, its usage remains relatively low, especially among the laggards who pick up on new technologies later than the general population. Studies have shown that even in well-developed countries, vaccination uptake among pregnant women is variable, with safety concerns, knowledge gaps, and lack of confidence among healthcare providers being key barriers (Xiao Qiu et al., 2021). Similarly, another study on barriers to immunization found insufficient knowledge about vaccination, safety concerns, and insufficient access to healthcare as the main culprits (Lindsay A Wilson et al., 2018). These factors are backed up by a study conducted among Canadian adults as well which identified several factors including lack of vaccine information as a reason for reduced vaccinations (Doris Stratoberdha et al., 2022).

Financial constraints were noted to be a reason for decreased vaccination uptake as well. Any kind of financial expenditures that are associated with immunization can demotivate people to go for health safety. These expenditures can include the cost of travel to locations to get an immunization, the opportunity cost of time that could be spent in doing other activities that could earn money e.g. skipping work to take your child for vaccination, or losing an opportunity to conduct business. In rural areas especially, people mostly earn from day to day with their earnings directly correlated to the amount of time they invest into work. This can serve as a hindrance to vaccine uptake as people can lose on their hard-earned profits.

In such circumstances, providing financial incentives to visit for vaccination can serve as a suitable intervention that can promote the visiting of health facilities for the purpose. This point is backed up by a study conducted in 2009 which identified that dismantling financial barriers is crucial for parents to fully accommodate their willingness to vaccinate their children, ensuring increased vaccine coverage and community health benefits (D. L. Wexler et al., 2009). There have been randomized control trials (RCTs) that have proved this point such as an RCT conducted on providing financial

incentives for hepatitis B which found that financial incentives for hepatitis B vaccination among people who inject drugs increased vaccination completion rates (C. Day et al., 2016).

Finally, our study showed that community engagement serves as the backbone of the vaccination program. Effective engagement of the society is imperative to promoting well-being and a sense of cohesion that can facilitate future projects as well. A cross-sectional survey, with a sample of 1926 participants during the

COVID-19 pandemic, suggested that accurate and effective communication and eradicating the vaccine skepticism and concerns about its effectiveness and side effects are critical to ending the vaccine resistance and arrival of herd immunity. (S. Guljaš et al., 2021). This aspect can also be applied to other forms of vaccination simply because most countries have one or the other vaccination program and Pakistan is not an exemption, as it has an EPI program that vaccinates for many diseases. The goal is to continue achieving efficient coverage of the targeted population to maintain a measure of faith in vaccination campaigns and consequently mobilize the community into giving booster doses for the sake of attaining herd immunity in the long run.

In conclusion, raising coverage of effective vaccines remains a difficult challenge that needs more strategies and more efforts at organizational, managerial, operational, and investment levels It is also necessary to plan for difficulties and challenges in advance such as those stated above. The challenges vary from area to area and to overcome these then one needs to have a good knowledge of the geographical, cultural, and financial status of the region. The same needs to be addressed to eliminate other factors that contribute to vaccination low coverage so that all the low-coverage areas of Poonch can get vaccinated.

CONCLUSIONS AND WAY FORWARD:

This proposed research outline focuses on the complex and diverse challenges that define vaccine hesitancy and disparities in vaccine distribution. Hence, the plan of the work builds on the thorough analysis of immunization challenges and the loss of opportunity in rural areas. It was only from a separate interview with parents and carers together with the medical personnel that it was possible to gain a wide understanding of the challenges that existed and were faced in the process of implementing effective immunization.

The outcomes prove the critical need to address the problem discussed by implementing effective gender-violence prevention strategies. These are the concerned issues particularly financial constraints, inadequate and limited knowledge/awareness, and access/transportation issues. Overall, they do not only create additional barriers to receiving immunization services but also reveal certain vaccination cover inefficiencies, as reflected in their high prevalence in rural areas.

Finally, the report portrays the key role of community support and participation in the development of immunization programs. The documented challenges do not outweigh the community's feeling of ownership regarding immunization. The possibility of local endeavors to improve vaccination rates and immunization is confirmed. Furthermore, more research and evaluation must be conducted to monitor progress, identify new challenges, and evaluate innovative approaches to immunization distribution. Through increased collaboration and addressing the root causes of vaccine hesitancy and opportunities, there is a large potential for gathering higher vaccination coverage and reducing vaccine-preventable disease burden in rural areas or elsewhere.

Acknowledgments:

The authors acknowledges and appreciates the support of all participants in this study.

References:

1. Ahmed, S. J. (2023). The protective role of maternal genetic immunization on maternal-feta health andwelfare. *International Journal of Gynecology & Obstetrics,*, 163(3), 763-777.
2. Ahmed, V. &. (2014). Poverty and social impact analysis of expanded program

on immunization in Pakistan.

3. Deal, A. C. (2023). Defining drivers of underimmunization and vaccine hesitancy in refugee and migrant populations. *Journal of Travel Medicine,* , 30(5), taad084.
4. Fadl, N. A. (2024). Routine childhood immunization in Sub-Saharan Africa: addressing parental vaccine hesitancy. . *Public Health,*, 226, 66-73.
5. Gul, S. &. (2016). Immunisation knowledge and practices among mothers attending a paediatric clinic in Karachi, Pakistan. *International Journal of Advances in Medicine,*, 3(3), 656-61.
6. Habib, S. S. (2024). Social determinants of low uptake of childhood vaccination in highrisk squatter settlements in Karachi, Pakistan–A step towards addressing vaccine inequity in urban slums. *Vaccine: X,*, 17, 100427.
7. Holon, I. Q. (2024). Health Innovation & Technology in Latin America & the Caribbean.
8. Hossain, I. M. (2021). Rethinking Strategies to Address Inequity in Immunization Services towards Achieving Universal Immunization Coverage (UIC) in
9. Karachi, Pakistan.
10. Hu, Y. W. (2018). Measles vaccination coverage, determinants of delayed vaccination and reasons for non-vaccination among children aged 24–35 months in Zhejiang province, China. *BMC public health,*, 18, 1-8.
11. Husain, S. &. (2016). Routine immunization services in Pakistan: seeing beyond the numbers. *EMHJ-Eastern Mediterranean Health Journal,* , 22(3), 201-211.
12. Jammeh, A. M. (2023). Comparing full immunisation status of children (0–23 months) between slums of Kampala City and the rural setting of Iganga District in Uganda: a cross-sectional study. . *BMC Health Services Research*, 23(1), 856.
13. Levin, A. B. (2023). Cost-effectiveness of measles and rubella elimination in lowincome and middle-income countries. . *BMJ Global Health*, 8(7), e011526.
14. Masud, T. &. (2012). The expanded program on immunization in Pakistan: recommendations for improving performance.
15. Minta, A. A. (2023). *Progress toward measles elimination—Worldwide, 2000–2022.* India: Morbidity and Mortality Weekly Report.
16. Muhammad, A. A. (2023). Barriers to childhood vaccination in urban slums of Pakistan.
17. *Eastern Mediterranean Health Journal,*, 29(5), 371-379.
18. Murtaza, F. M. (2016). Determinants of nonimmunization of children under 5 years of age in Pakistan. *Journal of Family and Community Medicine,*, 23(1), 32-37.
19. Pickering, L. K. (2009). Immunization programs for infants, children, adolescents, and adults: clinical practice guidelines by the Infectious Diseases Society of America. *Clinical Infectious Diseases*, 49(6), 817840.
20. Qayyum, K. R. (2021). Addressing community barriers to immunization in Rajanpur district, Pakistan: an implementation research. . *Journal of Global Health Reports*, 5, e2021088.
21. Rutten, L. (2023). Barriers to HPV Screening and Prevention in Latin America:. *A systematic Review.*
22. Ryman, T. K. (2008). Too little but not too late: results of a literature review to improve routine immunization programs in developing countries. *BMC Health Services Research,* , 8, 1-11.
23. Saman, S. C. (2023). Vaccines: an important tool for infectious disease. *Recent Advances in Anti-Infective Drug Discovery Formerly Recent Patents on Anti- Infective Drug Discovery,*, 18(2),88-109.
24. Shaikh, B. T. (2012). Strengthening health system with key strategies in the post devolution times in Pakistan.
25. Shen, A. K. (2014). The future of routine immunization in the developing world: challenges and opportunities. . *Global Health: Science and Practice,*, 2(4), 381394.

26. Singh, S. S. (2019). Barriers and opportunities for improving childhood immunization coverage in slums: A qualitative study. *Preventive medicine reports*, , 14, 100858.
27. Sodha, S. V. (2015). Strengthening routine immunization systems to improve global vaccination coverage. *British medical bulletin,*, 113(1), 5.
28. Stein, R. A. (2011). Vaccination: A public health intervention that changed history & is changing with history. *The american biology Teacher,*, 73(9), 513-519.
29. Tampi, M. C.-L.-G.-P. (2023). Systematic review on reducing missed opportunities for vaccinations in Latin America. *Revista Panamericana de Salud Pública,*, 46, e65.
30. Tampi, M. C.-L.-G.-P. (2023). Systematic review on reducing missed opportunities for vaccinations in Latin America. *Revista Panamericana de Salud Pública*, 46, e65.
31. Tang, X. Y. (2021). Multi-level determinants of failure to receive timely and complete measles vaccinations in Southwest China: a mixed methods study. *Infectious Diseases of Poverty*, , 10, 1-14.
32. Van Pelt, A. E.-N. (2023). Recommendations for empowering partners to conduct implementation research in Latin America to advance global health. *Global Implementation Research and Applications,*, 3(4), 390-399.
33. Wagner, A. L. (2014). Timely measles vaccination in Tianjin, China: a crosssectional study of immunization records and mothers. *BMC public health,*, 14, 1-7.
34. Abdulraheem, I., Onajole, A., Jimoh, A., & Oladipo, A. (2011). Reasons for incomplete vaccination and factors for missed opportunities among rural Nigerian children. *J Public Health Epidemiol, 3*(4), 194-203.
35. Barman, D., & Dutta, A. (2013). Access and barriers to immunization in West Bengal, India: quality matters. *Journal of health, population, and nutrition, 31*(4), 510.
36. Carter, A., Msemburi, W., Sim, S. Y., Gaythorpe, K. A., Lambach, P., Lindstrand, A., & Hutubessy, R. (2023). Modeling the impact of vaccination for the immunization Agenda 2030: Deaths averted due to vaccination against 14 pathogens in 194 countries from 2021 to 2030. *Vaccine*.
37. Cheng, M., Lan, T., Geater, A., Deng, Q.-Y., Lin, Y.-D., Jiang, L.-Y., . . . Tang, X.-Y. (2023). Health system barriers to timely routine measles vaccinations in rural southwest China: a qualitative study on the perspectives of township vaccination professionals and village doctors. *BMJ open, 13*(11), e072990.
38. Duclos, P., Okwo-Bele, J.-M., Gacic-Dobo, M., & Cherian, T. (2009). Global immunization: status, progress, challenges and future. *BMC international health and human rights, 9*, 1-11.
39. Garchitorena, A., Ihantamalala, F. A., Révillion, C., Cordier, L. F., Randriamihaja, M., Razafinjato, B., . . . Rakotonirina, J. (2021). Geographic barriers to achieving universal health coverage: evidence from rural Madagascar. *Health Policy and Planning, 36*(10), 1659-1670.
40. Guzman-Holst, A., DeAntonio, R., Prado-Cohrs, D., & Juliao, P. (2020). Barriers to vaccination in Latin America: A systematic literature review. *Vaccine, 38*(3), 470-481.
41. Hussain, S., Farooq, M., Nadeem, M., Siddiq, S., Ahmed, R. I., & Javed, I. (2020).
42. Immunization Status of Children: A Study at Shaikh Khalifa Bin Zayed AlNahyan Hospital Rawalakot Azad Kashmir. *Journal of Islamic International Medical College (JIIMC), 15*(3), 159-162.
43. Khaliq, A., Sayed, S. A., Hussaini, S. A., Azam, K., & Qamar, M. (2017). Missed immunization opportunities among children under 5 years of age dwelling in Karachi city. *Journal of Ayub Medical College, Abbottabad: JAMC, 29*(4), 645.
44. Landoh, D. E., Ouro-Kavalah, F., Yaya, I., Kahn, A.-L., Wasswa, P., Lacle, A., . . . Soura, A. B. (2016). Predictors of incomplete immunization coverage among one to five years old children in Togo. *BMC Public Health, 16*, 1-7.
45. Li, X., Mukandavire, C., Cucunubá, Z. M., Londono, S. E., Abbas, K., Clapham, H. E., . . .

Vynnycky, E. (2021). Estimating the health impact of vaccination against ten pathogens in 98 low-income and middle-income countries from 2000 to 2030: a modelling study. *The Lancet, 397*(10272), 398-408.

46. Lindstrand, A., Cherian, T., Chang-Blanc, D., Feikin, D., & O'Brien, K. L. (2021). The world of immunization: achievements, challenges, and strategic vision for the next decade. *The Journal of Infectious Diseases, 224*(Supplement_4), S452S467.
47. Machado, A. A., Edwards, S. A., Mueller, M., & Saini, V. (2021). Effective interventions to increase routine childhood immunization coverage in low socioeconomic status communities in developed countries: A systematic review and critical appraisal of peerreviewed literature. *Vaccine, 39*(22), 2938-2964.
48. Maurice, J. M., & Davey, S. (2009). *State of the World's Vaccines and Immunization*: World Health Organization.
49. Nagata, J. M., Epstein, A., Ganson, K. T., Benmarhnia, T., & Weiser, S. D. (2021). Drought and child vaccination coverage in 22 countries in sub-Saharan Africa: A retrospective analysis of national survey data from 2011 to 2019. *PLoS Medicine, 18*(9), e1003678.
50. Najda-Janoszka, M., & Kopera, S. (2014). Exploring barriers to innovation in tourism industry–the case of southern region of Poland. *Procedia-Social and Behavioral Sciences, 110*, 190-201.
51. Orenstein, W. A., & Ahmed, R. (2017). Simply put: Vaccination saves lives. In (Vol. 114, pp. 4031-4033): National Acad Sciences.
52. Orenstein, W. A., Seib, K., Graham-Rowe, D., & Berkley, S. (2014). Contemporary vaccine challenges: improving global health one shot at a time. *Science Translational Medicine, 6*(253), 253ps211-253ps211.
53. Organization, W. H. (2000). Maternal and neonatal tetanus elimination by 2005: strategies for achieving and maintaining elimination. *Maternal and neonatal tetanus elimination by 2005: strategies for achieving and maintaining elimination.*
54. Organization, W. H. (2001). *Measles: mortality reduction and regional elimination: strategic plan 2001-2005*. Retrieved from Organization, W. H. (2006). Challenges in global immunization and the global immunization vision and strategy 20062015. *Weekly Epidemiological Record= Relevé épidémiologique hebdomadaire, 81*(19), 190-195.
55. Organization, W. H. (2010). *World health statistics 2010*: World Health Organization.
56. Organization, W. H. (2013). Polio eradication and endgame strategic plan 2013–2018. *Global Polio Eradication Initiative, working draft, 23*, 1-99.
57. Piot, P., Larson, H. J., O'Brien, K. L., N'kengasong, J., Ng, E., Sow, S., & Kampmann, B. (2019). Immunization: vital progress, unfinished agenda.
58. *Nature, 575*(7781), 119-129.
59. Rehman, S. U., Siddiqui, A. R., Ahmed, J., Fatmi, Z., Shah, S. M., Rahman, A., & Yousafzai, M. T. (2017). Coverage and predictors of routine immunization among 12-23 months old children in disaster affected communities in Pakistan. *International journal of health sciences, 11*(1), 1.
60. Rutherford, M. E., Dockerty, J. D., Jasseh, M., Howie, S. R., Herbison, P., Jeffries, D. J., . . . Hill, P. C. (2009). Preventive measures in infancy to reduce under-five mortality: a case–control study in The Gambia. *Tropical Medicine & International Health, 14*(2), 149-155.
61. Shaikh, B. T., Haq, Z. U., Tran, N., & Hafeez, A. (2018). Health system barriers and levers in implementation of the Expanded Program on Immunization (EPI) in Pakistan: an evidence informed situation analysis. *Public health reviews, 39*, 1-10.
62. Wolfson, L. J., Gasse, F., Lee-Martin, S.-P., Lydon, P., Magan, A., Tibouti, A., . . . Okwo-Bele, J.-M. (2008). Estimating the costs of achieving the WHO-UNICEF Global Immunization Vision and Strategy, 2006-2015. *Bulletin of the World Health organization, 86*, 27-39.
63. Yazdani, A. T., Muhammad, A., Nisar, M. I., Khan, U., & Shafiq, Y. (2021). Unveiling and addressing implementation barriers to routine immunization in the peri-urban slums of Karachi,

Pakistan: a mixed methods study. *Health Research Policy and Systems, 19,* 1-9